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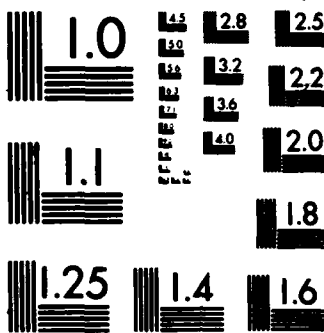
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TRADOC Analysis Command-Fort Leavenworth (TRAC-FLVN)
Scientific and Technical Support Directorate
Fort Leavenworth, Kansas 66027-5200

TERRAIN SOFTWARE CONVERSION

by

R.H. Pete Kaeding

ACN 48722

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CONTENTS

	<u>Page</u>
TITLE PAGE	i
DD FORM 1473	ii
ABSTRACT	iii
MAIN REPORT	1
Background	1
Original capabilities	1
Converted software capabilities	2
Software enhancements	4
Summary	6

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ABSTRACT

This document provides a brief history, identifies the capabilities, and outlines execution procedures for terrain data display and modification software originally written for Tektronix 4027 hardware. Conversion to a VAX/Ramtek environment and several capabilities enhancements are described, as well as procedures for executing the new package.

1. Background. In 1979, CASAA (now TRAC-FLVN) contracted BDM Corporation to produce a terrain data base for the Corps Battle Game (predecessor to CORDIVEM). Under the terms of this contract, BDM was to produce digitized terrain data, LOC and hydrography nets for virtually all of Germany. Shortly thereafter Data Management personnel developed software on a Tektronix 4027 terminal which utilized its graphics capability to allow display and modification of the data. There are actually two software packages involving graphics displays. The first package allows the user to display, and if necessary modify, the "features" (vegetation) data (see paragraph 2a). The second package allows display of digitized road and river data and the display, development, and modification of the "hex road equivalents" which were used in CORDIVEM and are currently used in CORBAN. In early April 1987, Scientific and Technical Support Directorate (STSD), Computer Support Division (CSD), Technology Applications Branch - Graphics Team (TAB-GT), was tasked to convert this capability to current hardware configurations. Currently, TRAC-FLVN's primary graphics hardware is the Ramtek 9400 series accessed through any of several VAX computers in-house.

2. Original capabilities. The Tektronix 4027-compatible Data Management produced software allowed the user to display and modify terrain data as required. The total package consists of five subpackages which perform various data manipulation functions. Each subpackage consists of 20-35 subroutines with some overlap. Conversion was required for only the two of these subpackages involving graphics displays. Each of these is described in detail below while the converted packages are described in paragraph 3.

a. Features data. Prior to execution of this software the user had to do several logical unit assignments required during execution. Execution was reasonably straightforward with the user responding to prompts, e.g.:

Enter the coordinates of the SW corner

Features?

Contours?

Contour interval? (if yes above)

<program displays appropriate terrain map with color bar legend>

Corrections to features?

Color? (if yes above)

<program displays crosshairs on the screen which the user positions by using the keypad arrow keys and striking any key to designate vertices of a polygon representing the new area to be filled in with the selected color, to terminate, user must select key C.>

Another patch?

<if yes, all above steps are repeated; if no, the old data file is automatically overwritten>

b. Roads & rivers data. Prior to execution of this software, the user had to do several logical unit assignments required during execution. Execution was reasonably straightforward with the user responding to prompts, e.g.:

Loc or hydro?

Hex size?

Roads? (may imply rivers depending on first response)

Enter map name, terminate with a period please

<program now displays the selected area overlayed by the level of hex chosen with some hex sides in color to represent the type of river flow between hexes (or with hex center joining segments to represent the area road network) followed by the display of the digitized road (or river) data and a set of crosshairs for modifying the hex data. While in this mode, the user can "erase" or "refresh" selected road (or river) types by using the 4027 function keys>

More changes?

3. Converted software capabilities. Top priority was given to assuring no loss of capability in the conversion effort. Certain modes of operation were modified (e.g. the removal of function-key usage to avoid future compatibility problems) but the user remains able to perform all functions as before, and in several instances, more easily. In addition, a number of package enhancements were incorporated and are delineated in paragraph 4.

a. Features data. Software was consolidated into a single text library and corresponding object library under a single directory heading (currently [terrain.surface.display]). All internal references were changed to reference commons co-located in a single directory (currently [terrain.common]). The appropriate logical assignments are all accomplished by executing the "terrain" login file. Programmer documentation exists both in the converted routines and in a separate file titled "Odoc.doc" located in the same directory as the software. To execute the current terrain software, the user need only locate himself at a terminal near a Ramtek monitor and graphics tablet (site is not important as TAB-GT has modified the application software and the applicable graphics package (CGIP) to be compatible with all TAB-FLVM hardware configurations) and do as follows:

ASSIGN DISK:[DIR] TERDISK (where DISK:[DIR] is the disk/directory location of top level terrain software)

@TERDISK:LOGIN (executes the above mentioned login file)

RUNDISP (does logical assignments & executes the software)

RM__ : (appropriate Ramtek logical for your site - on monitor)

Do you wish to change color values?

Change which color code?

<current RGB intensities for selected color are displayed>

Enter new intensities

Change another color?

Enter the coordinates of the SW corner (0,0 to end)

Features?

Contours?

Contour interval? (if yes above)

Enter coarseness factor

<program displays appropriate terrain map with color bar legend>

Corrections to features?

Color? (if yes above)

Terminate polygon definition by entering cursor position outside map

<program "turns on" the cursor and activates the graph tablet for polygon definition via the graphics pen/puck>

Another patch?

<if yes, all of the above steps are repeated>

Do you wish to save all new data to file? (if no above)

New version of <data file name> has been created (if yes above)

d. Roads and rivers data. Software was consolidated into a single text library and corresponding object library under a single directory heading (currently [terrain.locnex.hex]). All internal references were changed to reference commons co-located in a single directory (currently [terrain.common]). The appropriate logical assignments are all accomplished by executing the "terrain" login file. Programmer documentation exists both in the converted routines and in a separate file titled "Odoc.doc" located in the same directory as the software. To execute the current terrain software, the user need only locate himself at a terminal near a Ramtek monitor and graphics tablet (site is not important as TAB-GT has modified the application software and the applicable graphics package (CGIP) to be compatible with all TRAC-FLVN

hardware configurations) and do as follows:

ASSIGN DISK:[DIR] TERDISK (where DISK:[DIR] is the disk/directory location of top level terrain software)

@TERDISK:LOGIN (executes the above mentioned login file)

RUNROAD or RUNRIVER (this does the appropriate logical assignments & executes the software)

Loc or hydro?

Hex size?

Enter map name, terminate with a period please

RM__: (appropriate Ramtek logical for your site - on monitor)

Do you want hex autobahns (or major rivers) displayed?

Do you want hex main roads (or rivers) displayed?

Do you want hex secondary roads (or streams) displayed?

<program displays hex overlay for selected area with hex roads (or rivers) as specified>

Change your display? (if yes, the three "do you want" prompts repeat. This option allows the user to "turn off" or "refresh" only the hex roads or rivers if desired.)

Do you want digitized roads (or rivers)?

Do you want digitized autobahns (or major rivers) displayed?

Do you want digitized main roads (or rivers) displayed?

Do you want digitized secondary roads (or streams) displayed?

<program displays digitized roads (or rivers) as specified>

Change your display? (if yes, same as above)

Enter road (or river) type to draw/delete (user selects type of hex road/river to insert)

Use graph tablet to do as follows:

Select starting hex for road (or river)

Select ending hex for road

<program draws appropriate segment>

More changes?

4. Software enhancements. This section describes in more detail each of the enhancements incorporated in the two packages described in paragraph 3. A

comparison of paragraphs 2 and 3 will identify the prompt differences which often correlate with enhancements.

a. General. A terrain software package specific login file was created to establish the required symbol and logical assignments for compiling and/or executing the software. All files/routines specific to a package reside in the same directory; however, generic routines required by multiple packages reside elsewhere (these can be determined most easily by looking at the appropriate link file, e.g., OLINKDISP.COM).

b. Features data. Numerous enhancements to this package were incorporated as follows:

RUNDISP - A procedure file (ORUNDISP.COM) was developed to get the user to the appropriate location and execute the software.

Ramtek logical - Enhancements to the CGIP graphics package require only that the user supply the four-character Ramtek logical identification for execution on any of our hardware configurations. These ID's can be found on a label on the monitor selected (e.g., RMA0:).

Change color values - This addition was purely aesthetic. This feature allows the user to personalize color schemes for the execution session. Since the software's intended process is tedious and detailed, it's quite easy to become eye fatigued. The user can select any or all colors and modify the intensities (RGB) to his own personal preference.

Exiting software - Previously no provision for exiting existed. The user was required to interrupt the process by, for example, a CTRL-Y.

Coarseness factor - The software originally drew 400 vertical lines, each representing a 100-meter swath while varying the color of the line as necessary to portray the variety of vegetation found in that area. For better display on the Ramtek hardware, the package was modified to draw rectangles rather than lines. The coarseness factor then varies the number of "vertical" rectangles drawn to be $400/c$, where c is the coarseness factor. The time to draw the map is then reduced by the reciprocal of the coarseness factor. (E.g., if the user selects a coarseness factor of 2, the software will draw 200 "vertical" rectangles in 1/2 the time.)

Graph tablet usage - The original software made use of Tektronix 4027 features not available on the current hardware configuration. The modification of features data on the Tektronix was affected by moving crosshairs to locate each vertex of a potentially 500-sided polygon. In the new package, this is accomplished using a graph tablet and puck/pen and is terminated by the user entering any point (potential vertex) outside the map boundaries.

Optional save of changes - The original software automatically saved whatever changes the user generated (whether correct or not) and, worse, overwrote the original data file. The new package prompts the user prior to saving the data and notifies him that a new version of the file has been created (cleanup of obsolete files is then the user's responsibility).

c. Roads and river data. Several enhancements to this package were incorporated as follows:

RUNROAD - a procedure file (ORUNROAD.COM) was developed to get the user to the appropriate location and execute the software as applicable to road network development.

RUNRIVER - a procedure file (ORUNRIVER.COM) was developed to get the user to the appropriate location and execute the software as applicable to river network development.

Color labels - Color labels identifying the association between roads/ivers and their corresponding color graphics representation are now displayed along the left-hand margin on the monitor. Previously, no link between display and representation existed (the user had to be "software smart").

Selection of hex and digitized representations - The new package allows the user to "turn on or off" any or all of the three types of hex road/river displays and then allows the same flexibility with the digitized displays. Similar capability existed previously but not as flexibly. In both cases this capability is invaluable as an assist to the user allowing display of only those roads/ivers he's interested in modifying.

Road/river generation - Previously this process was affected by using crosshairs to identify the hexes containing the newly generated road/river. In the new package this process is accomplished by using the graph tablet and puck/pen.

5. Summary. A package developed, and used by TRAC-FLVN Data Management personnel to view and modify terrain data used by several of TRAC-FLVN's war game simulations was compatible only with Tektronix 4027 hardware. TAB-GT was tasked to convert the software to be VAX/Ramtek compatible primarily to allow for access of the Tektronix hardware. There are five software packages in all that were developed for these purposes, but only two involved graphics and therefore needed revision. Top priority was no loss of software capabilities, with enhancements where feasible to simplify or improve the execution procedures. Paragraph 3 describes the revised packages' capabilities and execution procedures, and paragraph 4 highlights only the enhancements included in the conversion effort.

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